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(71) Applicant
W.A. Deutsher Proprietary Limited
600 South Road, Moorabbin, Victoria, 3189, Australia

(72) Inventor
David Roberts

(74) Agent and/or Address for Service
Gill Jennings & Every
53-64 Chancery Lane, London, WC2A 1HN,
United Kingdom

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UK CL (Edition K) F2H HAA
INT CL[6] F16B 25/00 25/02 25/04 25/06 25/08 25/10

(54) Screw and method of making same

(57) A self-drilling self-tapping screw for use in fastening corrugated cladding to a support structure, is provided with a hole enlarger 7 comprising axially extending ribs 8 for enlarging (e.g. by reaming) a hole already formed through the cladding by the drilling tip 3 of the screw. The hole enlarger 7 is positioned at or adjacent the junction between a threaded section 4 of the shank and a non-threaded section 5. The hole enlarger 7 ensures that the enlarged hole has a diameter no less than that of the non-threaded section 5 of the shank. The screw is formed by a method in which the thread is rolled, and the thread rolling die is modified so as to produce the hole enlarger 7 on the screw shank. The enlargement of the hole prevents damage to an anti-corrosion coating on the screw.

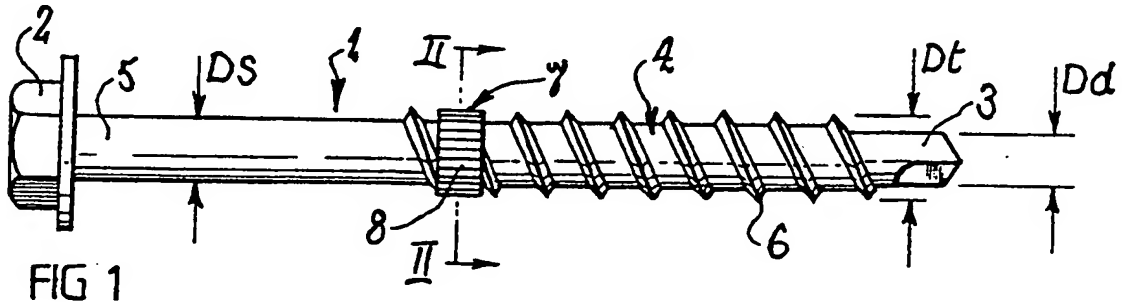

FIG 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

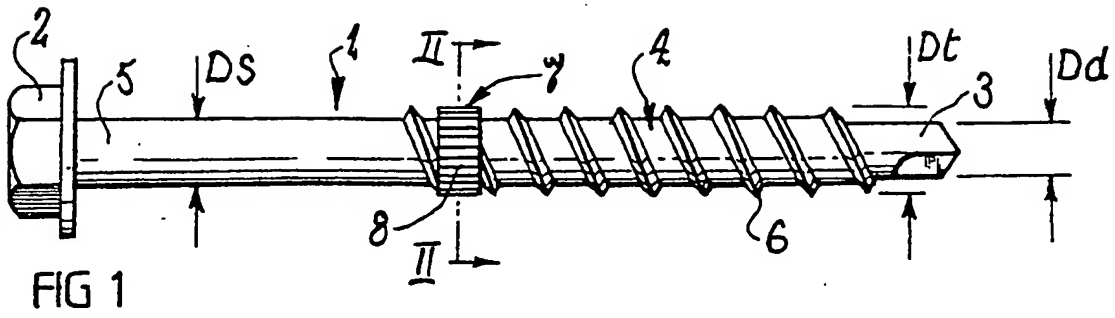

FIG 1

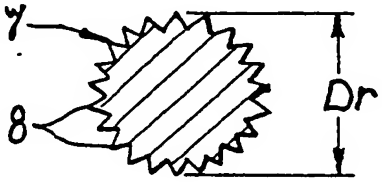

FIG 2

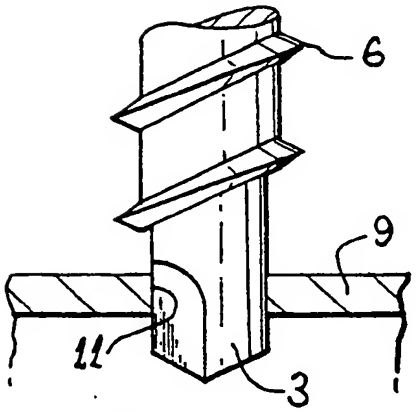

FIG 3

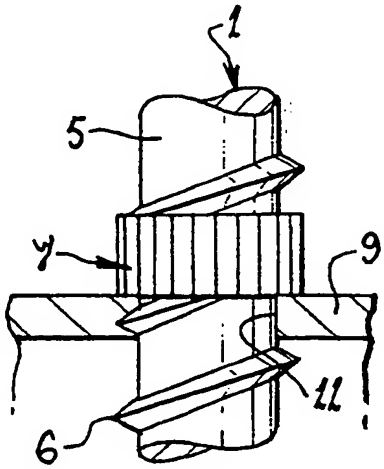

FIG 4

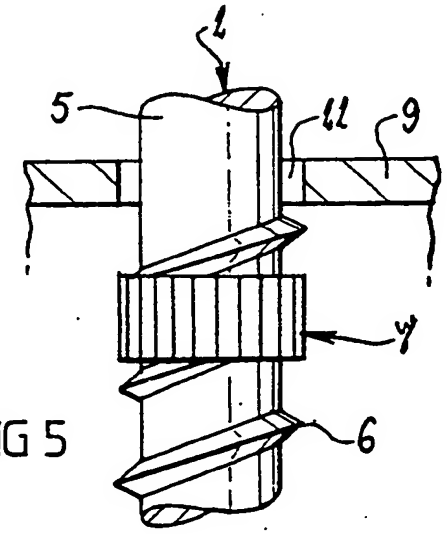

FIG 5

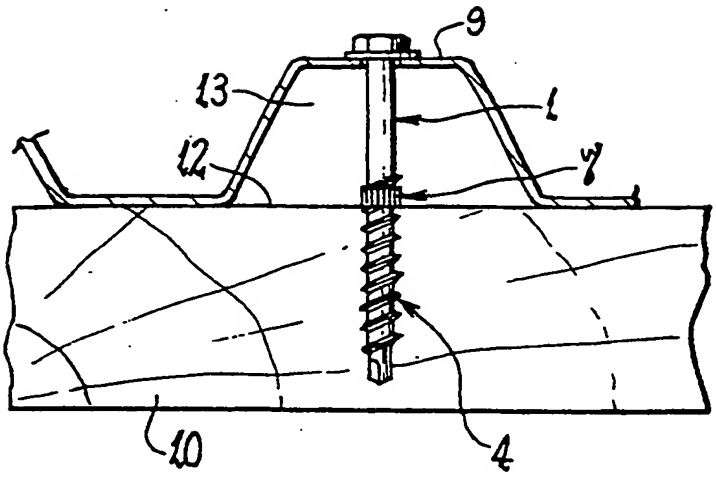

FIG 6

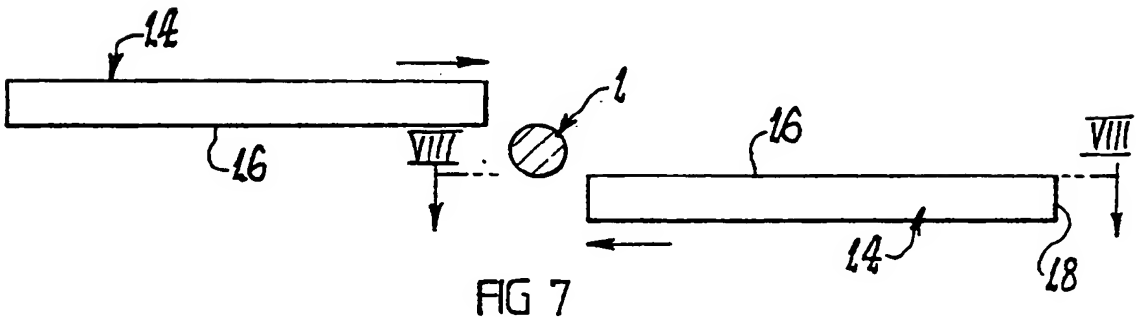

FIG 7

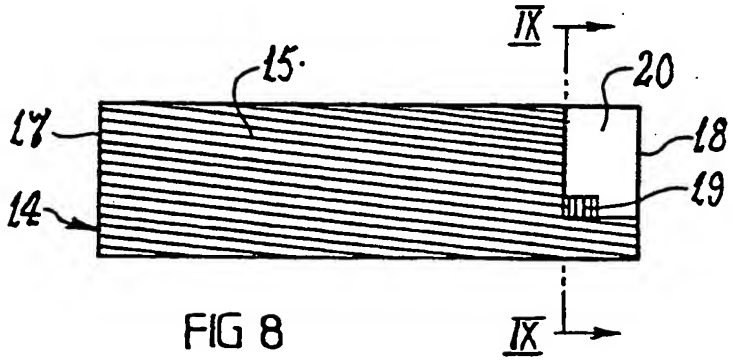

FIG 8

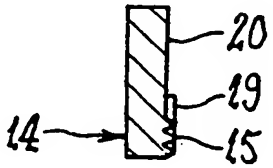

FIG 9

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IMPROVED SCREW AND METHOD OF MAKING SAME

This invention relates to screws of the self-drilling and self-tapping kind. Such screws are well known and have a variety of applications. It is a feature of such screws that they have a drilling tip which is operable to form a hole in a support member, and a threaded section which is able to form a co-operating complementary thread in that hole.

One use of self-drilling screws is to secure metal cladding to roof and wall structures. Such cladding is commonly of corrugated or similar form in cross-section so as to have a plurality of alternating ridges and valleys. The crest of each ridge, and the base of each valley, may be curved or flat. Metal cladding of that kind may be secured to an underlying frame of metal or timber.

When a self-drilling screw is used to secure such metal cladding to a frame, it is generally arranged with its head bearing against the crest of a ridge and the threaded end section of the screw engages within an underlying frame member. A section of the screw shank, which is not screw threaded, extends between the cladding ridge and the frame member. When installing the screw, the drill tip of the screw cuts a hole through the cladding to permit passage of the screw to the underlying frame member, and that drill tip subsequently serves to cut a hole in the frame member. The threaded section of the screw then forms a co-operating complementary thread in the latter hole and the screw is thereby fastened to the frame member.

A problem arises when the screw is to be used in high load situations and particularly situations which require the screw to have substantial resistance to corrosion. An example situation of that kind is where the screw is used to fasten roof cladding in a high wind area having a corrosive environment - e.g., located close to saltwater. In such cases, the corrosion resistance factor is generally created by providing the screw with a suitable coating - e.g., by galvanising, electroplating, mechanical plating, or application of a barrier coat system. The integrity of any such coating is important to the ability of the screw to resist corrosion.

It is quite common in screws of the foregoing kind for the non-threaded shank section to have a diameter greater than that of the hole formed by the drill tip. Thus, when the screw is being installed the shank needs to be forced through the hole in the cladding, and that tends to cause removal of the protective coating from parts of the screw shank. It will often be the case that those parts of the shank will remain exposed between the cladding and the frame member when the screw is finally fastened in position, and consequently will be subjected to the corrosive environment.

Such partial destruction of the protective coating can have serious consequences, and will not be observable in many cases. That is, there may be no knowledge of the loss of corrosion resistance until the screw fails under load due to corrosion occurring at the damaged areas.

It is an object of the present invention to provide an improved self-drilling screw which overcomes or at least minimises the foregoing problem. It is a further object of the invention to provide a method of forming such a screw.

A screw according to the invention is characterised in that it incorporates a feature which is operative during installation of the screw to enlarge a hole formed by the drill tip. In a preferred form of the screw that enlarging feature is located in axially spaced relationship from both the drill tip and the screw head. Ideally, the feature is located within the threaded section at or adjacent the junction between that section and the non-threaded shank portion of the screw.

The enlarging feature may have any suitable form. In one particular embodiment of the invention it is composed of a series of ribs which extends around the circumference of the screw. Those ribs are provided in a section of the screw which can be of any appropriate length, but it is generally unnecessary for that section to be substantially longer than the axial length of the drill tip. The crest diameter of the ribbed section is greater than, or at least equal to, the diameter of the non-threaded shank section of the screw.

A method according to the invention involves forming the threaded portion of the screw by a thread rolling technique,

and providing the rolling dies with means whereby a hole enlarging feature as referred to above is automatically formed on the screw towards the end of the thread forming operation. That method will be further explained in the following description of one particular form of screw which incorporates an embodiment of the invention.

Embodiments of the invention are described in detail in the following passages of the specification which refer to the accompanying drawings. The drawings, however, are merely illustrative of how the invention might be put into effect, so that the specific form and arrangement of the various features as shown is not to be understood as limiting on the invention.

In the drawings:

Figure 1 is a side elevation view of a typical screw to which an embodiment of the invention has been applied.

Figure 2 is an enlarged transverse cross-sectional view taken along line II-II of Figure 1.

Figure 3 is a view of the drilling tip portion of the Figure 1 screw, shown on an enlarged scale, and shown penetrating a portion of cladding.

Figure 4 is a view similar to Figure 3 but showing the screw projected axially through the cladding to an extent such that the threaded portion of the screw is within the wall of the cladding.

Figure 5 is a view similar to Figure 4 but showing the axial projection of the screw at a further stage at which the hole enlarging feature of the screw has projected through the cladding wall.

Figure 6 is a cross-sectional view showing a screw according to Figure 1, securing typical cladding to a support structure.

Figure 7 is a diagrammatic view of a pair of thread rolling dies as may be used to form the threaded section on the screw of Figure 1.

Figure 8 is a view of one of the thread rolling dies taken along line VIII-VIII of Figure 7.

Figure 9 is a transverse cross-sectional view taken along line IX-IX of Figure 8.

Figure 1 of the drawings shows an example self-drilling

and self-tapping screw to which an embodiment of the invention has been applied. That screw includes an elongate shank 1 and a head 2 at one end of the shank 1. The tip end of the shank 1 is formed in a known manner to provide a drilling tip 3, and a threaded section 4 is formed on the shank 1 adjacent to the drilling tip 3. A plane non-threaded section 5 of the shank extends between the head 2 and the threaded section 4.

It is common practice to form the thread 6 in the section 4 by a thread rolling process, but other thread forming techniques could be applied. In a typical screw of the kind shown, the diameter Ds of the plane section 5 is greater than the maximum diameter Dd of the drilling tip 3 and is less than the crest diameter Dt of the thread 6. As a consequence, the diameter Ds is greater than the root diameter of a thread formed by the threaded section 4 in a hole cut by the drill tip 3. It is generally unacceptable to enlarge the diameter Dd to bring it closer to the diameter Ds because that would reduce the depth of the thread formed in the aforementioned hole and thereby reduce the holding power of the screw.

The screw shown has been modified in accordance with the invention by addition of a hole enlarging feature 7 at or adjacent the junction of the shank sections 4 and 5. Another location may be chosen for the feature 7 but it is generally found that best results occur with the feature 7 at or adjacent to the location shown in Figure 1.

In the particular example shown, the feature 7 is formed by a series of ribs 8 (Figure 2), each of which extends generally in the longitudinal direction of the shank 1. The series extends completely around the circumference of the shank 1 and has an outer diameter Dr which is greater than, or at least equal to, the diameter Ds of the shank plane section 5. It will be appreciated that the feature 7 may have a form different to that shown by Figures 1 and 2.

When a screw as shown is used to fasten cladding 9 to a support member 10 (Figure 6), the drilling tip 3 first forms a hole 11 of diameter Dd in the cladding 9 as shown in Figure 3. As the screw is moved axially towards the member 10, the threaded section 4 operates to a thread in the hole 11 (Figure

4), but that thread has no purpose in the final assembly. After the section 4 has completed, or substantially completed, its passage through the hole 11, the ribs 8 function to enlarge the hole 11 as shown in Figure 5. That enlargement results from a reaming-type action performed by the ribs 8, and enables the shank plane section 5 to pass through the cladding 9 with clearance, or at least without such interference as to damage, substantially damage, the corrosion resistance capacity of the screw.

It follows that any protective coating of the plane section 5 will not be damaged, at least not substantially, as the screw is projected through the cladding 9 to adopt the final fastening condition as shown in Figure 6. It is preferred, as shown at Figure 6, that the enlarging feature 7 is positioned at or adjacent the upper surface 12 of the support member 10. Ideally, that feature 7 is positioned close to the surface 12 so that at least the major part of the screw which is exposed to the space 13 formed by the cladding 9, is the shank plane section 5. It is relevant in that regard that the protective coating on the section 5 has not been damaged, and consequently the screw is unlikely to suffer substantial deterioration by corrosion over a period of time. The support member 10 may be made of any material including metal and timber. If it is made of timber, the feature 7 may be positioned below the surface 12, but such an arrangement is unlikely if the member 10 is made of steel.

As previously stated, it is preferred to form the thread 6 by a rolling method. Figure 7 shows, in diagrammatic form, the screw shank 1 arranged to be acted upon by thread rolling dies 14. Each die 14 has a series 15 of thread forming grooves provided in the surface 16 (Figure 7) which is presented to the shank 1 during the thread forming operation. The two dies 14 are moved in opposite directions as shown by the arrows in Figure 7 so as to subject the shank 1 to their influence and thereby form the thread 6. In that regard, each die 14 has a leading edge 17 and a trailing edge 18.

Each die 14 is modified in accordance with one aspect of the invention so that the enlarging feature 7 is formed automatically during the thread rolling operation. In the

embodiment shown in the drawings, each die 14 is modified by providing a series 19 of alternating ridges and valleys in the surface 16 at a location adjacent the die trailing edge 18. Each ridge of the series 19 extends transverse to the direction of movement of the die 14, and the series 19 is located at a position such as to produce the ribs 8 in the shank 1 at the desired location along that shank.

The die 14 is further modified by providing an undercut zone 20 behind and to one side of the series 19 so that there is no further disturbance of the shank 1 by the die 14 after the series 19 has passed over the shank 1.

It will be apparent that the enlarging feature 7 can be formed by methods other than that described above, but the described method has the advantage of simplicity and economy of cost. In particular, the screw is endowed with the feature of the invention without being subjected to an operation additional to those performed for producing screws not incorporating the invention.

Various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit or ambit of the invention.

CLAIMS:

1. A screw of the self-drilling and self-tapping kind including, an elongate cylindrical shank, an enlarged head at one end of the shank, a drilling tip at the other end of the shank, a threaded section provided on said shank adjacent said drilling tip, a non-threaded section of said shank located adjacent said head, and a hole enlarging feature provided on said shank at or adjacent the junction between said threaded and non-threaded sections and being operable to form a hole of diameter no less than the diameter of said non-threaded section.

2. A screw according to claim 1, wherein said feature is located within said threaded section adjacent said junction.

3. A screw according to any preceding claim, wherein said feature comprises a series of ribs which extends around the circumference of said shank, and each rib in the series extends generally in the axial direction of said shank and is spaced laterally from each of the two adjacent ribs.

4. A screw according to claim 3, wherein the length of each said rib is not substantially greater than the axial length of said drilling tip.

5. A screw according to claim 3 or 4, wherein the diameter of the ribbed feature is greater than the diameter of said non-threaded section.

6. A screw according to any preceding claim wherein the axial spacing between said head and said feature is pre-determined so that when said screw operates to fasten cladding to a support structure, said feature is positioned between opposed surfaces of the cladding and the support structure respectively and is adjacent to the said support structure surface.

7. A method of forming a screw according to any preceding claim, wherein the thread of said threaded section is formed by a thread rolling operation, and said feature is formed simultaneous with a final stage of said thread rolling operation.

8. A method according to claim 7, wherein formation of said feature is completed prior to completion of said thread

rolling operation.

9. A thread rolling die for use in a method according to claim 7 or 8, including a body having a leading end and a trailing end relative to the intended direction of movement of said die during a thread forming operation, a series of thread forming grooves in a surface of said body, said grooves extending angularly relative to said direction of movement, a series of alternating ridges and valleys formed on said surface adjacent said trailing end and adjacent one longitudinal side of said body, said ridges and valleys extending generally transverse to said direction of movement, and an undercut zone formed in a corner of said surface and extending from said series of ridges and valleys to said trailing end and to the longitudinal side of said body remote from said one side.

10. A screw substantially as described with reference to the accompanying drawings.

11. A method of forming a screw substantially as described with reference to the accompanying drawings.

12. A thread rolling die substantially as described particularly with reference to Figures 8 and 9.

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